STANDARD

ANSI/ASHRAE/IBPSA Addendum d to
ANSI/ASHRAE Standard 205-2023

Representation of Performance Data for HVAC&R and Other Facility Equipment

Approved by ASHRAE and the American National Standards Institute on August 29, 2025, and by the International Building Performance Simulation Association on August 12, 2025.

This addendum was approved by a Standing Standard Project Committee (SSPC) for which the Standards Committee has established a documented program for regular publication of addenda or revisions, including procedures for timely, documented, consensus action on requests for change to any part of the standard. Instructions for how to submit a change can be found on the ASHRAE® website (www.ashrae.org/continuous-maintenance).

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Foreword to Addendum *d*

Standard 205-2023 Addendum d generalizes the RS0001 representation specification to cover liquid-cooled, air-cooled, and evaporatively-cooled chillers. The representation specification title is changed from "Liquid-Cooled Chiller" to "Chiller" to reflect this broader scope.

[This addendum makes changes to the current standard indicated in the text by underlining (for additions) and strikethrough (for deletions) except where instructions specifically describe some other means of showing the changes.]

5.8 Common Enumerations. Common enumerations are used in more than one representation specification.

When a representation specification includes data elements of enumerations listed in this section, the specified enumerators shall be used.

Table 5–5 SchemaType

Enumerator	Attributes
RS0001	**Description:** ~~Liquid-Cooled~~ Chiller
RS0002	**Description:** Unitary Cooling Air-Conditioning Equipment
RS0003	**Description:** Fan Assembly
RS0004	**Description:** Air-to-Air Direct Expansion Refrigerant System
RS0005	**Description:** Motor
RS0006	**Description:** Electronic Motor Drive
RS0007	**Description:** Mechanical Drive

Table 5–6 CompressorType

Enumerator	Attributes
RECIPROCATING	**Description:** Reciprocating compressor
SCREW	**Description:** Screw compressor
CENTRIFUGAL	**Description:** Centrifugal compressor
ROTARY	**Description:** Rotary compressor
SCROLL	**Description:** Scroll compressor

Table 5–7 SpeedControlType

Enumerator	Attributes
DISCRETE	**Description:** Loading is controlled by cycling between one or more discrete stages
CONTINUOUS	**Description:** Loading is controlled by continuously varying the speed

Table 5–8 CondenserType

Enumerator	Attributes
AIR	**Description:** Air-cooled condenser
LIQUID	**Description:** Liquid-cooled condenser
EVAPORATIVE	**Description:** Evaporative condenser **Notes:** Evaporative condensers include adiabatically-cooled condensers

Table 5–9 LiquidConstituent

Enumerator	Attributes
WATER	**Description:** Water
PROPYLENE_GLYCOL	**Description:** Propylene glycol
ETHYLENE_GLYCOL	**Description:** Ethylene glycol
SODIUM_CHLORIDE	**Description:** Sodium chloride
CALCIUM_CHLORIDE	**Description:** Calcium chloride
ETHANOL	**Description:** Ethanol
METHANOL	**Description:** Methanol

Table 5–10 ConcentrationType

Enumerator	Attributes
BY_VOLUME	**Description:** Concentration is defined as a fraction of total liquid mixture volume
BY_MASS	**Description:** Concentration is defined as a fraction of total liquid mixture mass

Table 5–11 OperationState

Enumerator	Attributes
NORMAL	**Description:** Indicates that the equipment is in normal operating state
STANDBY	**Description:** Indicates that the equipment is in standby operating state

RS0001 ~~LIQUID-COOLED~~ CHILLER

RS0001.1 Identification and History. `schema`: RS0001

`schema_version`	Date	Initial Approved Standard	Notes
1.0.0	2023	2023	Initial publication
2.0.0	2024	2023 - Addenda a, b, & c	
3.0.0	2025	2023 - Addendum d	Add air-cooled and evaporatively-cooled condensers

RS0001.2 Scope and Description

RS0001.2.1 Applicability. Electrically driven vapor compression liquid-chilling packages that include one or more hermetic or open drive compressors (centrifugal, screw, scroll, reciprocating, rotary or other types) and are equipped with a liquid-cooled, air-cooled, or evaporatively-cooled condenser.

RS0001.2.2 Exclusions. Steam turbine driven, combustion engine driven, absorption liquid-chilling and liquid-heating packages, nor chillers with a separate heat recovery liquid stream.

RS0001.2.3 Embedded Representations. None.

RS0001.2.4 Referencing Representations. None.

RS0001.2.5 Schematic. Figure RS0001–1 shows a schematic of a liquid-cooled vapor compression refrigeration liquid-chilling package with notes below, Figure RS0001–2 shows a schematic of an air-cooled vapor compression refrigeration liquid-chilling package, and Figure RS0001–3 shows a schematic of an evaporatively-cooled vapor compression refrigeration liquid-chilling package.

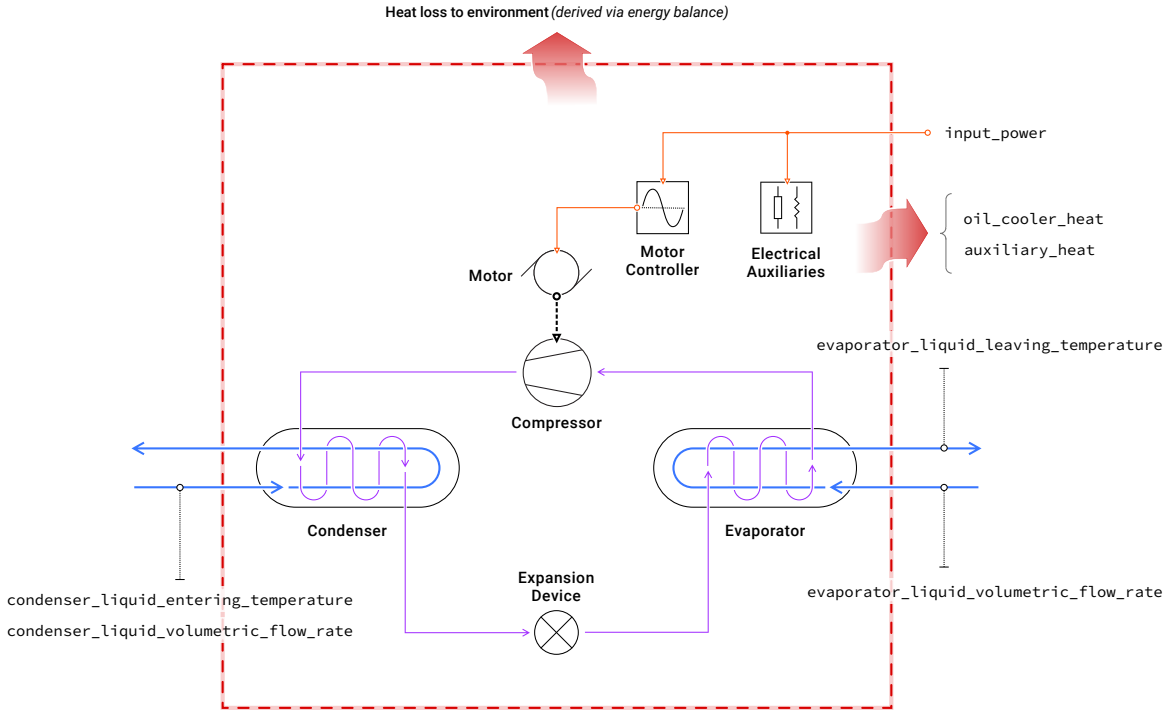

Figure RS0001–1 Liquid-cooled chiller.

- Electrical auxiliaries are components such as control system power, block/compressor/crankcase/oil heaters, purge units, or other devices.
- "Heat loss to space" includes any heat that is dissipated to the air where the chiller is located and is determined by applying the energy balance for the chiller as described in Section RS0001.4.1
- `auxiliary_heat` and `oil_cooler_heat` represent liquid cooled heat exchangers providing auxiliary cooling and/or oil cooling not captured in evaporator or condenser performance values. If the heat loss is captured within the chiller and accounted for in the performance data, then no additional heat flows need to be accounted for. These heat flows are represented as the required heat rejection and not the temperature and flow of the liquid streams providing the cooling.

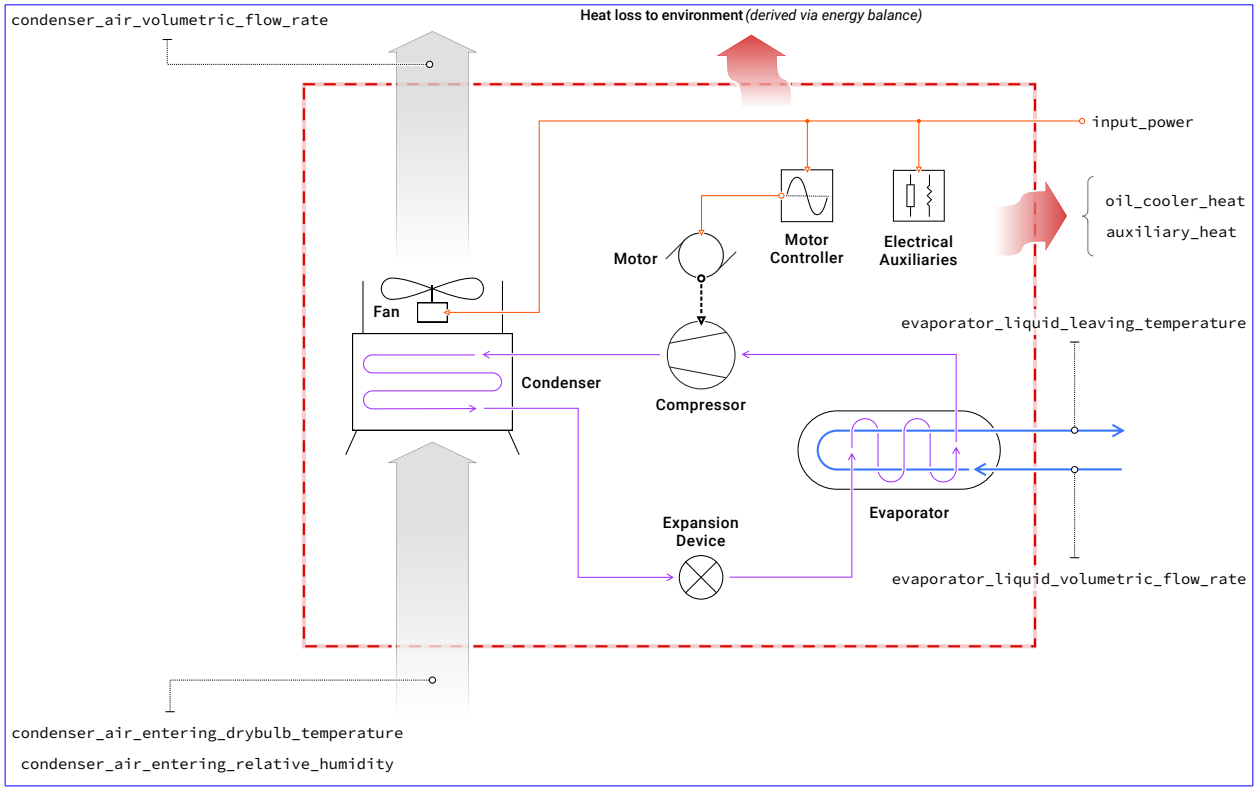

Figure RS0001–2 Air-cooled chiller.

- Electrical auxiliaries are components such as control system power, block/compressor/crankcase/oil heaters, purge units, or other devices.
- "Heat loss to space" includes any heat that is dissipated to the air where the chiller is located and is determined by applying the energy balance for the chiller as described in Section RS0001.4.1
- `auxiliary_heat` and `oil_cooler_heat` represent liquid cooled heat exchangers providing auxiliary cooling and/or oil cooling not captured in evaporator or condenser performance values. If the heat loss is captured within the chiller and accounted for in the performance data, then no additional heat flows need to be accounted for. These heat flows are represented as the required heat rejection and not the temperature and flow of the liquid streams providing the cooling.

- Electrical auxiliaries are components such as control system power, block/compressor/crankcase/oil heaters, purge units, or other devices.

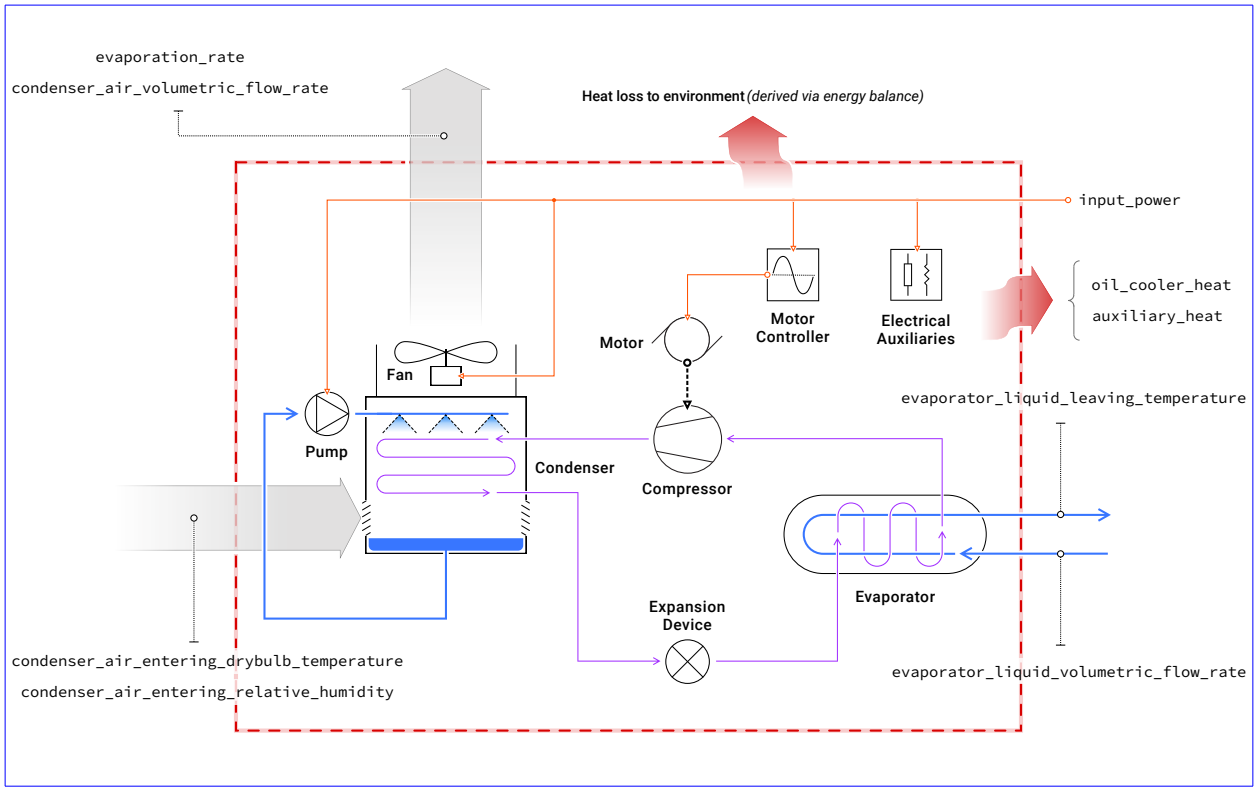

Figure RS0001–3 Evaporatively-cooled chiller.

- "Heat loss to space" includes any heat that is dissipated to the air where the chiller is located and is determined by applying the energy balance for the chiller as described in Section RS0001.4.1

- `auxiliary_heat` and `oil_cooler_heat` represent liquid cooled heat exchangers providing auxiliary cooling and/or oil cooling not captured in evaporator or condenser performance values. If the heat loss is captured within the chiller and accounted for in the performance data, then no additional heat flows need to be accounted for. These heat flows are represented as the required heat rejection and not the temperature and flow of the liquid streams providing the cooling.

RS0001.3 Data Model

RS0001.3.1 Data Group Hierarchy. A representation implementation conforming to this representation specification shall consist of the following data groups:

- RS0001
  - Metadata
  - Description*
    - ProductInformation*
    - RatingAHRI550590*
    - RatingAHRI551591*
  - Performance
    - ~~PerformanceMapCooling~~
      - ~~GridVariablesCooling~~
      - ~~LookupVariablesCooling~~
    - PerformanceMapCoolingLiquid
      - GridVariablesCoolingLiquid
      - LookupVariablesCoolingLiquid

- PerformanceMapCoolingAir
  - GridVariablesCoolingAir
  - LookupVariablesCoolingAir
- PerformanceMapCoolingEvaporative
  - GridVariablesCoolingEvaporative
  - LookupVariablesCoolingEvaporative
- PerformanceMapStandby
  - GridVariablesStandby
  - LookupVariablesStandby
- PerformanceMapEvaporatorLiquidPressureDifferential
  - GridVariablesEvaporatorLiquidPressureDifferential
  - LookupVariablesEvaporatorLiquidPressureDifferential
- PerformanceMapCondenserLiquidPressureDifferential
  - GridVariablesCondenserLiquidPressureDifferential
  - LookupVariablesCondenserLiquidPressureDifferential

where * indicates data groups that are not required to be present in a representation conforming to this representation specification.

Informative note: Required data elements of an optional data group are only required when the data group in present in a representation.

Informative note: When multiple chillers are designed to operate in concert, such as in a series counterflow arrangement, the performance of the chiller system can be represented in a single file. Other designs with multiple chillers operating independently should be represented with multiple files.

RS0001.3.2 Enumerations

Table RS0001–2 AHRI550590TestStandardYear

Enumerator	Attributes
IP_2015	**Description:** Ratings and design points defined using IP unit version of the standard, 2015 edition[1]
IP_2015_ADDENDUM_1	**Description:** Ratings and design points defined using IP unit version of the standard, 2015 edition with Addendum 1[2]
IP_2018	**Description:** Ratings and design points defined using IP unit version of the standard, 2018 edition[3]
IP_2020	**Description:** Ratings and design points defined using IP unit version of the standard, 2020 edition[4]
IP_2020_ADDENDUM_1	**Description:** Ratings and design points defined using IP unit version of the standard, 2020 edition with Addendum 1[5]
IP_2023	**Description:** Ratings and design points defined using IP unit version of the standard, 2023 edition[6]

Table RS0001–3 AHRI551591TestStandardYear

Enumerator	Attributes
SI_2015	**Description:** Ratings and design points defined using SI unit version of the standard, 2015 edition[7]
SI_2015_ADDENDUM_1	**Description:** Ratings and design points defined using SI unit version of the standard, 2015 edition with Addendum 1[8]
SI_2018	**Description:** Ratings and design points defined using SI unit version of the standard, 2018 edition[9]
SI_2020	**Description:** Ratings and design points defined using SI unit version of the standard, 2020 edition[10]
SI_2020_ADDENDUM_1	**Description:** Ratings and design points defined using SI unit version of the standard, 2020 edition with Addendum 1[11]
SI_2023	**Description:** Ratings and design points defined using SI unit version of the standard, 2023 edition[12]

RS0001.3.3 Data Groups

Table RS0001–4 RS0001

Name	Attributes
`metadata`	**Description:** Metadata data group **Data Type:** `{Metadata}` **Constraints:** `schema=RS0001` **Req:** ✓
`description`	**Description:** Data group describing product and rating information **Data Type:** `{Description}`
`performance`	**Description:** Data group containing performance information **Data Type:** `{Performance}` **Req:** ✓

Table RS0001–5 Description

Name	Attributes
`product_information`	**Description:** Data group describing product information **Data Type:** `{ProductInformation}`
`rating_ahri_550_590`	**Description:** Data group containing information relevant to products rated under AHRI 550/590 **Data Type:** `{RatingAHRI550590}`
`rating_ahri_551_591`	**Description:** Data group containing information relevant to products rated under AHRI 551/591 **Data Type:** `{RatingAHRI551591}`

Table RS0001–6 ProductInformation

Name	Attributes
`manufacturer`	**Description:** Manufacturer name **Data Type:** `String`
`model_number`	**Description:** Model number **Data Type:** `Pattern` **Notes:** Pattern shall match all model numbers that can be represented by the representation
`nominal_voltage`	**Description:** Unit nominal voltage **Data Type:** `Numeric` **Units:** V **Constraints:** `≥0.0` **Notes:** If the unit can operate at multiple voltages, the lower of the two shall be stated
`nominal_frequency`	**Description:** Unit nominal frequency **Data Type:** `Numeric` **Units:** Hz **Constraints:** `≥0.0` **Notes:** Power supply frequency for the intended region of installation
`compressor_type`	**Description:** Type of compressor **Data Type:** `<CompressorType>`

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Name	Attributes
`liquid_data_source`	**Description:** Source of the liquid properties data **Data Type:** `String` **Notes:** Example: 'ASHRAE Handbook Fundamentals 2013 chapter 31'
`refrigerant`	**Description:** Refrigerant used in the chiller **Data Type:** `String` **Notes:** The string shall start with 'R-' and then include the refrigerant number designation conforming to ANSI/ASHRAE Standard 34[13]
`hot_gas_bypass_installed`	**Description:** Indicates if a hot-gas bypass valve is installed on the chiller **Data Type:** `Boolean`

Table RS0001–7 RatingAHRI550590

Name	Attributes
`certified_reference_number`	**Description:** AHRI certified reference number **Data Type:** `String`
`test_standard_year`	**Description:** Year of the AHRI test standard **Data Type:** `<AHRI550590TestStandardYear>`
`rating_source`	**Description:** Source of this rating data **Data Type:** `String` **Notes:** Used by data publisher to document methods (e.g., software and version) used to generate rating data
`net_refrigerating_capacity`	**Description:** Rated net refrigeration capacity **Data Type:** `Numeric` **Units:** Btu/h **Constraints:** `≥0.0` **Notes:** The capacity of the evaporator available for cooling of the thermal load external to the chiller; calculated using only the sensible heat transfer
`input_power`	**Description:** Combined power input of all components of the unit, including auxiliary power and excluding integral pumps **Data Type:** `Numeric` **Units:** kW **Constraints:** `≥0.0`
`cop`	**Description:** Ratio of the net refrigerating capacity to the total input power at the rating conditions **Data Type:** `Numeric` **Units:** - **Constraints:** `>0.0`
`iplv_ip`	**Description:** The Integrated Part-Load Value efficiency of merit calculated at the standard rating conditions **Data Type:** `Numeric` **Units:** -
`nplv_ip`	**Description:** The Non-Standard Part-Load Value efficiency of merit calculated at the conditions other than the IPLV.IP conditions **Data Type:** `Numeric` **Units:** -

Table RS0001–8 RatingAHRI551591

Name	Attributes
certified_reference_number	**Description:** AHRI certified reference number **Data Type:** String
test_standard_year	**Description:** Year of the AHRI test standard **Data Type:** <AHRI551591TestStandardYear>
rating_source	**Description:** Source of this rating data **Data Type:** String **Notes:** Used by data publisher to document methods (e.g., software and version) used to generate rating data
net_refrigerating_capacity	**Description:** Rated net refrigeration capacity **Data Type:** Numeric **Units:** kW **Constraints:** ≥0.0 **Notes:** The capacity of the evaporator available for cooling of the thermal load external to the chiller; calculated using only the sensible heat transfer
input_power	**Description:** Combined power input of all components of the unit, including auxiliary power and excluding integral pumps **Data Type:** Numeric **Units:** kW **Constraints:** ≥0.0
cop	**Description:** Ratio of the net refrigerating capacity to the total input power at the rating conditions **Data Type:** Numeric **Units:** - **Constraints:** >0.0
iplv_si	**Description:** The Integrated Part-Load Value efficiency of merit calculated at the standard rating conditions **Data Type:** Numeric **Units:** -
nplv_si	**Description:** The Non-Standard Part-Load Value efficiency of merit calculated at the conditions other than the IPLV.SI conditions **Data Type:** Numeric **Units:** -

Table RS0001–9 Performance

Name	Attributes
condenser_type	**Description:** Heat rejection method of the condenser **Data Type:** <CondenserType> **Req:** ✓
evaporator_liquid_type	**Description:** Type of liquid in evaporator **Data Type:** {LiquidMixture} **Req:** ✓ **Notes:** • LiquidMixture specifies liquid constituents and their concentrations • Density shall be evaluated at the evaporator inlet liquid temperature

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Name	Attributes
condenser_liquid_type	**Description:** Type of liquid in condenser **Data Type:** {LiquidMixture} **Req:** ~~✓~~if condenser_type=LIQUID **Notes:** • LiquidMixture specifies liquid constituents and their concentrations • Density shall be evaluated at the condenser inlet liquid temperature
evaporator_fouling_factor	**Description:** Factor of heat transfer inhibition due to heat exchanger fouling layer **Data Type:** Numeric **Units:** $m^2 \cdot K/W$ **Constraints:** ≥0.0 **Req:** ✓ **Notes:** • Evaporator fouling factor at which the performance map was created • May be different from the certification data supplied
condenser_fouling_factor	**Description:** Factor of heat transfer inhibition due to heat exchanger fouling layer **Data Type:** Numeric **Units:** $m^2 \cdot K/W$ **Constraints:** ≥0.0 **Req:** ~~✓~~if condenser_type=LIQUID **Notes:** • Condenser fouling factor at which the performance map was created • May be different from the certification data supplied
compressor_speed_control_type	**Description:** Type of compressor speed control **Data Type:** <SpeedControlType> **Req:** ✓
cycling_degradation_coefficient	**Description:** Cycling degradation coefficient (C_D) as described in AHRI 550/590 or AHRI 551/591 **Data Type:** Numeric **Units:** - **Constraints:** ≥0.0, ≤1.0 **Req:** ✓ **Notes:** Used when the unit cycles to meet a setpoint
scaling	**Description:** Specifies the range the performance data can be scaled to represent different capacity equipment **Data Type:** {Scaling} **Notes:** If not present, scaling of the performance data is not allowed
performance_map_cooling	**Description:** Data group describing cooling performance over a range of conditions **Data Type:** ({~~PerformanceMapCooling~~PerformanceMapCoolingLiquid}, {PerformanceMapCoolingAir}, {PerformanceMapCoolingEvaporative}) **Constraints:** condenser_type(LIQUID, AIR, EVAPORATIVE) **Req:** ✓
performance_map_standby	**Description:** Data group describing standby performance **Data Type:** {PerformanceMapStandby} **Req:** ✓

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Name	Attributes
performance_map_evaporator_liquid_pressure_differenti	**Description:** Data group describing the liquid pressure differential through the evaporator **Data Type:** {PerformanceMapEvaporatorLiquidPressureDifferential} **Req:** ✓
performance_map_condenser_liquid_pressure_differentia	**Description:** Data group describing the liquid pressure differential through the condenser **Data Type:** {PerformanceMapCondenserLiquidPressureDifferential} **Req:** ~~✓~~if condenser_type=LIQUID

Table RS0001–10 ~~PerformanceMapCooling~~PerformanceMapCoolingLiquid

Name	Attributes
grid_variables	**Description:** Data group defining the grid variables for cooling performance **Data Type:** {~~GridVariablesCooling~~GridVariablesCoolingLiquid} **Req:** ✓
lookup_variables	**Description:** Data group defining the lookup variables for cooling performance **Data Type:** {~~LookupVariablesCooling~~LookupVariablesCoolingLiquid} **Req:** ✓

Table RS0001–11 ~~GridVariablesCooling~~GridVariablesCoolingLiquid

Name	Attributes
evaporator_liquid_volumetric_flow_rate	**Description:** Chilled liquid (evaporator) flow **Data Type:** [Numeric][1..] **Units:** m^3/s **Constraints:** >0.0 **Req:** ✓ **Scalable:** ✓
evaporator_liquid_leaving_temperature	**Description:** Leaving evaporator liquid temperature **Data Type:** [Numeric][1..] **Units:** K **Constraints:** >0.0 **Req:** ✓
condenser_liquid_volumetric_flow_rate	**Description:** Condenser liquid flow **Data Type:** [Numeric][1..] **Units:** m^3/s **Constraints:** >0.0 **Req:** ✓ **Scalable:** ✓
condenser_liquid_entering_temperature	**Description:** Entering condenser liquid temperature **Data Type:** [Numeric][1..] **Units:** K **Constraints:** >0.0 **Req:** ✓

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Name	Attributes
`compressor_sequence_number`	**Description:** Index indicating the relative capacity order of the compressor speed/stage expressed in order from lowest capacity (starting at 1) to highest capacity **Data Type:** `[Integer][1..]` **Units:** - **Constraints:** `≥1` **Req:** ✓ **Notes:** • If `compressor_speed_control_type` is `DISCRETE`, sequence numbers shall be provided for each discrete stage of the compressor(s) • If `compressor_speed_control_type` is `CONTINUOUS`, sufficient sequence numbers shall be provided to capture the continuous operation of the compressor(s)

Table RS0001–12 ~~LookupVariablesCooling~~LookupVariablesCoolingLiquid

Name	Attributes
`input_power`	**Description:** Total power input **Data Type:** `[Numeric][1..]` **Units:** W **Constraints:** `≥0.0` **Req:** ✓ **Scalable:** ✓ **Notes:** All power consumed by the chiller, including controls, motors, variable speed drives, purge units, sump heaters, fans, etc.
`net_evaporator_capacity`	**Description:** Refrigeration capacity **Data Type:** `[Numeric][1..]` **Units:** W **Constraints:** `≥0.0` **Req:** ✓ **Scalable:** ✓ **Notes:** The available cooling capacity of the evaporator to the thermal load calculated using only the sensible heat transfer
`net_condenser_capacity`	**Description:** Condenser heat rejection **Data Type:** `[Numeric][1..]` **Units:** W **Constraints:** `≥0.0` **Req:** ✓ **Scalable:** ✓ **Notes:** The capacity of the condenser transferred to the condenser cooling stream using only the sensible heat transfer

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Name	Attributes
`oil_cooler_heat`	**Description:** Heat transferred to another liquid crossing the control volume boundary from the chiller oil cooler. **Data Type:** `[Numeric][1..]` **Units:** W **Constraints:** `≥0.0` **Req:** ✓ **Scalable:** ✓ **Notes:** Set as 0 if not present or if heat rejection is met by condenser
`auxiliary_heat`	**Description:** Heat transferred to another liquid crossing the control volume boundary from the chiller auxiliaries (motor, motor controller, inverter drive, starter, etc). **Data Type:** `[Numeric][1..]` **Units:** W **Constraints:** `≥0.0` **Req:** ✓ **Scalable:** ✓ **Notes:** Set as 0 if not present or if heat rejection is met by condenser
`operation_state`	**Description:** The operation state at the operating conditions **Data Type:** `[<OperationState>]` **Units:** - **Req:** ✓

Table RS0001–13 PerformanceMapCoolingAir

Name	Attributes
`grid_variables`	**Description:** Data group defining the grid variables for cooling performance **Data Type:** `{GridVariablesCoolingAir}` **Req:** ✓
`lookup_variables`	**Description:** Data group defining the lookup variables for cooling performance **Data Type:** `{LookupVariablesCoolingAir}` **Req:** ✓

Table RS0001–14 GridVariablesCoolingAir

Name	Attributes
`evaporator_liquid_volumetric_flow_rate`	**Description:** Chilled liquid (evaporator) flow **Data Type:** `[Numeric][1..]` **Units:** m^3/s **Constraints:** `>0.0` **Req:** ✓ **Scalable:** ✓

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Name	Attributes
evaporator_liquid_leaving_temperature	**Description:** Leaving evaporator liquid temperature **Data Type:** [Numeric][1..] **Units:** K **Constraints:** >0.0 **Req:** ✓
condenser_air_entering_drybulb_temperature	**Description:** Entering condenser air drybulb temperature **Data Type:** [Numeric][1..] **Units:** K **Constraints:** >0.0 **Req:** ✓
condenser_air_entering_relative_humidity	**Description:** Entering condenser air relative humidity **Data Type:** [Numeric][1..] **Units:** - **Constraints:** ≥0.0, ≤1.0 **Req:** ✓
ambient_pressure	**Description:** Ambient pressure used to calculate the performance **Data Type:** [Numeric][1..] **Units:** Pa **Constraints:** >0.0 **Req:** ✓ **Notes:** Informative Note: the intent of the ambient pressure is to capture the pressure at the installation and not changes in the ambient pressure due to weather effects
compressor_sequence_number	**Description:** Index indicating the relative capacity order of the compressor speed/stage expressed in order from lowest capacity (starting at 1) to highest capacity **Data Type:** [Integer][1..] **Units:** - **Constraints:** ≥1 **Req:** ✓ **Notes:** • If compressor_speed_control_type is DISCRETE, sequence numbers shall be provided for each discrete stage of the compressor(s) • If compressor_speed_control_type is CONTINUOUS, sufficient sequence numbers shall be provided to capture the continuous operation of the compressor(s)

Table RS0001–15 LookupVariablesCoolingAir

Name	Attributes
input_power	**Description:** Total power input **Data Type:** [Numeric][1..] **Units:** W **Constraints:** ≥0.0 **Req:** ✓ **Scalable:** ✓ **Notes:** All power consumed by the chiller, including controls, motors, variable speed drives, purge units, sump heaters, fans, etc.
net_evaporator_capacity	**Description:** Refrigeration capacity **Data Type:** [Numeric][1..] **Units:** W **Constraints:** ≥0.0 **Req:** ✓ **Scalable:** ✓ **Notes:** The available cooling capacity of the evaporator to the thermal load calculated using only the sensible heat transfer
net_condenser_capacity	**Description:** Condenser heat rejection **Data Type:** [Numeric][1..] **Units:** W **Constraints:** ≥0.0 **Req:** ✓ **Scalable:** ✓ **Notes:** The capacity of the condenser transferred to the condenser cooling stream using only the sensible heat transfer
condenser_air_volumetric_flow_rate	**Description:** Condenser air flow **Data Type:** [Numeric][1..] **Units:** m^3/s **Constraints:** >0.0 **Req:** ✓ **Scalable:** ✓
oil_cooler_heat	**Description:** Heat transferred to another liquid crossing the control volume boundary from the chiller oil cooler. **Data Type:** [Numeric][1..] **Units:** W **Constraints:** ≥0.0 **Req:** ✓ **Scalable:** ✓ **Notes:** Set as 0 if not present or if heat rejection is met by condenser

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Name	Attributes
auxiliary_heat	**Description:** Heat transferred to another liquid crossing the control volume boundary from the chiller auxiliaries (motor, motor controller, inverter drive, starter, etc). **Data Type:** [Numeric][1..] **Units:** W **Constraints:** ≥0.0 **Req:** ✓ **Scalable:** ✓ **Notes:** Set as 0 if not present or if heat rejection is met by condenser
operation_state	**Description:** The operation state at the operating conditions **Data Type:** [<OperationState>] **Units:** - **Req:** ✓

Table RS0001–16 PerformanceMapCoolingEvaporative

Name	Attributes
grid_variables	**Description:** Data group defining the grid variables for cooling performance **Data Type:** {GridVariablesCoolingEvaporative} **Req:** ✓
lookup_variables	**Description:** Data group defining the lookup variables for cooling performance **Data Type:** {LookupVariablesCoolingEvaporative} **Req:** ✓

Table RS0001–17 GridVariablesCoolingEvaporative

Name	Attributes
evaporator_liquid_volumetric_flow_rate	**Description:** Chilled liquid (evaporator) flow **Data Type:** [Numeric][1..] **Units:** m^3/s **Constraints:** >0.0 **Req:** ✓ **Scalable:** ✓
evaporator_liquid_leaving_temperature	**Description:** Leaving evaporator liquid temperature **Data Type:** [Numeric][1..] **Units:** K **Constraints:** >0.0 **Req:** ✓

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Name	Attributes
condenser_air_entering_drybulb_temperature	**Description:** Entering condenser air drybulb temperature **Data Type:** [Numeric][1..] **Units:** K **Constraints:** >0.0 **Req:** ✓
condenser_air_entering_relative_humidity	**Description:** Entering condenser air relative humidity **Data Type:** [Numeric][1..] **Units:** - **Constraints:** ≥0.0, ≤1.0 **Req:** ✓
ambient_pressure	**Description:** Ambient pressure used to calculate the performance **Data Type:** [Numeric][1..] **Units:** Pa **Constraints:** >0.0 **Req:** ✓ **Notes:** Informative Note: the intent of the ambient pressure is to capture the pressure at the installation and not changes in the ambient pressure due to weather effects
compressor_sequence_number	**Description:** Index indicating the relative capacity order of the compressor speed/stage expressed in order from lowest capacity (starting at 1) to highest capacity **Data Type:** [Integer][1..] **Units:** - **Constraints:** ≥1 **Req:** ✓ **Notes:** • If compressor_speed_control_type is DISCRETE, sequence numbers shall be provided for each discrete stage of the compressor(s) • If compressor_speed_control_type is CONTINUOUS, sufficient sequence numbers shall be provided to capture the continuous operation of the compressor(s)

Table RS0001–18 LookupVariablesCoolingEvaporative

Name	Attributes
input_power	**Description:** Total power input **Data Type:** [Numeric][1..] **Units:** W **Constraints:** ≥0.0 **Req:** ✓ **Scalable:** ✓ **Notes:** All power consumed by the chiller, including controls, motors, variable speed drives, purge units, sump heaters, fans, etc.

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Name	Attributes
net_evaporator_capacity	**Description:** Refrigeration capacity **Data Type:** [Numeric][1..] **Units:** W **Constraints:** ≥0.0 **Req:** ✓ **Scalable:** ✓ **Notes:** The available cooling capacity of the evaporator to the thermal load calculated using only the sensible heat transfer
net_condenser_capacity	**Description:** Condenser heat rejection **Data Type:** [Numeric][1..] **Units:** W **Constraints:** ≥0.0 **Req:** ✓ **Scalable:** ✓ **Notes:** The capacity of the condenser transferred to the condenser cooling stream using only the sensible heat transfer
condenser_air_volumetric_flow_rate	**Description:** Condenser air flow **Data Type:** [Numeric][1..] **Units:** m^3/s **Constraints:** >0.0 **Req:** ✓ **Scalable:** ✓
evaporation_rate	**Description:** Rate at which water evaporates from the condenser. **Data Type:** [Numeric][1..] **Units:** m^3/s **Constraints:** ≥0.0 **Req:** ✓ **Scalable:** ✓ **Notes:** Does not include blow down or drift losses.
oil_cooler_heat	**Description:** Heat transferred to another liquid crossing the control volume boundary from the chiller oil cooler. **Data Type:** [Numeric][1..] **Units:** W **Constraints:** ≥0.0 **Req:** ✓ **Scalable:** ✓ **Notes:** Set as 0 if not present or if heat rejection is met by condenser

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Name	Attributes
auxiliary_heat	**Description:** Heat transferred to another liquid crossing the control volume boundary from the chiller auxiliaries (motor, motor controller, inverter drive, starter, etc). **Data Type:** [Numeric][1..] **Units:** W **Constraints:** ≥0.0 **Req:** ✓ **Scalable:** ✓ **Notes:** Set as 0 if not present or if heat rejection is met by condenser
operation_state	**Description:** The operation state at the operating conditions **Data Type:** [<OperationState>] **Units:** - **Req:** ✓

Table RS0001–19 PerformanceMapStandby

Name	Attributes
grid_variables	**Description:** Data group defining the grid variables for standby performance **Data Type:** {GridVariablesStandby} **Req:** ✓
lookup_variables	**Description:** Data group defining the lookup variables for standby performance **Data Type:** {LookupVariablesStandby} **Req:** ✓

Table RS0001–20 GridVariablesStandby

Name	Attributes
environment_dry_bulb_temperature	**Description:** Dry bulb temperature of the air in the environment of the chiller **Data Type:** [Numeric][1..] **Units:** K **Constraints:** >0.0 **Req:** ✓

Table RS0001–21 LookupVariablesStandby

Name	Attributes
`input_power`	**Description:** Total power consumed in standby operation **Data Type:** `[Numeric][1..]` **Units:** W **Constraints:** `≥0.0` **Req:** ✓ **Scalable:** ✓ **Notes:** • Includes devices that cycle on and off (e.g., purge units and sump units) and devices that draw continuous power (e.g., fans and controls) • Expressed as a time averaged power consumption

Table RS0001–22 PerformanceMapEvaporatorLiquidPressureDifferential

Name	Attributes
`grid_variables`	**Description:** Data group defining the grid variables for the evaporator liquid pressure differential **Data Type:** `{GridVariablesEvaporatorLiquidPressureDifferential}` **Req:** ✓
`lookup_variables`	**Description:** Data group defining the lookup variables for the evaporator liquid pressure differential **Data Type:** `{LookupVariablesEvaporatorLiquidPressureDifferential}` **Req:** ✓

Table RS0001–23 GridVariablesEvaporatorLiquidPressureDifferential

Name	Attributes
`evaporator_liquid_volumetric_flow_rate`	**Description:** Chilled liquid (evaporator) flow **Data Type:** `[Numeric][1..]` **Units:** m^3/s **Constraints:** `>0.0` **Req:** ✓
`evaporator_liquid_leaving_temperature`	**Description:** Leaving evaporator liquid temperature **Data Type:** `[Numeric][1..]` **Units:** K **Constraints:** `>0.0` **Req:** ✓

Table RS0001–24 LookupVariablesEvaporatorLiquidPressureDifferential

Name	Attributes
`evaporator_liquid_differential_pressure`	**Description:** Pressure difference across the evaporator **Data Type:** `[Numeric][1..]` **Units:** Pa **Constraints:** `>0.0` **Req:** ✓

Table RS0001–25 PerformanceMapCondenserLiquidPressureDifferential

Name	Attributes
`grid_variables`	**Description:** Data group defining the grid variables for the condenser liquid pressure differential **Data Type:** `{GridVariablesCondenserLiquidPressureDifferential}` **Req:** ✓
`lookup_variables`	**Description:** Data group defining the lookup variables for the condenser liquid pressure differential **Data Type:** `{LookupVariablesCondenserLiquidPressureDifferential}` **Req:** ✓

Table RS0001–26 GridVariablesCondenserLiquidPressureDifferential

Name	Attributes
`condenser_liquid_volumetric_flow_rate`	**Description:** Condenser liquid flow **Data Type:** `[Numeric][1..]` **Units:** m^3/s **Constraints:** `>0.0` **Req:** ✓
`condenser_liquid_entering_temperature`	**Description:** Entering condenser liquid temperature **Data Type:** `[Numeric][1..]` **Units:** K **Constraints:** `>0.0` **Req:** ✓

Table RS0001–27 LookupVariablesCondenserLiquidPressureDifferential

Name	Attributes
`condenser_liquid_differential_pressure`	**Description:** Pressure difference across the condenser **Data Type:** `[Numeric][1..]` **Units:** Pa **Constraints:** `>0.0` **Req:** ✓

RS0001.4 Verification Rules

RS0001.4.1 Chiller Heat Balance. Heat balance of a system shall be used to verify conservation of energy. At the highest level, the heat balance is represented by the following equation:

$$\sum \text{Energy}_{\text{In}} = \sum \text{Energy}_{\text{Out}}$$

In the simplest chiller system, this can be represented as:

$$\dot{P}_{\text{in}} + \dot{Q}_{\text{evap}} = \dot{Q}_{\text{cond}}$$

Referring to Figure RS0001-1, this is expanded to:

$$\dot{P}_{\text{in}} + \dot{Q}_{\text{evap}} = \dot{Q}_{\text{cond}} + \dot{Q}_{\text{lossToSpace}} + \dot{Q}_{\text{oilCooler}} + \dot{Q}_{\text{auxiliary}}$$

All these terms are provided in the performance tables except for the losses to the space, which can be calculated as the differences between the other energy flows:

$$\dot{Q}_{\text{lossToSpace}} = (\dot{P}_{\text{in}} + \dot{Q}_{\text{evap}}) - (\dot{Q}_{\text{cond}} + \dot{Q}_{\text{oilCooler}} + \dot{Q}_{\text{auxiliary}})$$

The resulting loss to the space shall not be negative:

$$\dot{Q}_{\text{lossToSpace}} \geq 0$$

Informative note: There may be other losses in the system, such as the pressure effects on the physical state of the liquid flow under high pressure differentials, but for the intended use of the performance data provided in accordance with this standard, those losses have been considered negligible.

RS0001.4.2 Nomenclature

Symbol	Data element	Description
$\dot{P}_{\text{in}}$	`input_power`	Power input to the refrigeration system, W
$\dot{Q}_{\text{evap}}$	`net_evaporator_capacity`	Heat addition rate from the chilled liquid stream to the refrigeration system at the evaporator, W
$\dot{Q}_{\text{cond}}$	`net_condenser_capacity`	Heat rejection rate from the refrigeration system to the cooling liquid stream at the chiller, W
$\dot{Q}_{\text{losstoSpace}}$		Rate of thermal energy generated by the equipment that is lost to the surroundings (the portion of input power that is not transferred as useful work to the refrigeration system), W
$\dot{Q}_{\text{oilCooler}}$	`oil_cooler_heat`	Rate of thermal energy generated by the equipment that is lost through a liquid cooled oil cooler that exits the control volume through a separate liquid stream, W
$\dot{Q}_{\text{auxiliary}}$	`auxiliary_heat`	Rate of thermal energy generated by the equipment that is lost through liquid cooled auxiliaries that exits the control volume through a separate liquid stream, W

RS0001.5 Publishing Rules. None.

RS0001.6 Application Rules

RS0001.6.1 Cooling Performance. `performance_map_cooling` shall be used to simulate performance when system controls call for cooling.

RS0001.6.2 Standby Performance. `performance_map_standby` shall be used to simulate performance under any of the following conditions:

a. system controls are not calling for cooling, or
b. system controls are calling for cooling, but either:
    1. the current simulated conditions are outside the range of grid variables in `performance_map_cooling`, or
    2. the corresponding lookup variable `operation_state` in `performance_map_cooling` has a value of STANDBY at the current simulated conditions.

RS0001.6.3 Fluid Types. The fluid type used in the simulation shall be the same as defined in the representation. A warning shall be provided to the software user if the fluid types do not match.

RS0001.6.4 Evaporative Condenser Water Use. The evaporation rate from the condenser is provided in the performance map. The total water usage of the evaporatively-cooled condenser also includes make-up water flow rate based on the cycles of concentration determined by the water chemistry at the installation and any drift losses from the condenser.

RS0001.7 References

1. AHRI. *AHRI 550/590 (I-P) 2015: Performance Rating of Water-chilling and Heat Pump Water-heating Packages Using the Vapor Compression Cycle*. Arlington, Virginia: AHRI, 2015.
2. AHRI. *AHRI 550/590 (I-P) 2015 with Addendum 1: Performance Rating of Water-chilling and Heat Pump Water-heating Packages Using the Vapor Compression Cycle*. Arlington, Virginia: AHRI, 2017.
3. AHRI. *AHRI 550/590 (I-P) 2018 with Errata: Performance Rating of Water-chilling and Heat Pump Water-heating Packages Using the Vapor Compression Cycle*. Arlington, Virginia: AHRI, 2018.
4. AHRI. *AHRI 550/590 (I-P/2020): Performance Rating of Water-chilling and Heat Pump Water-heating Packages Using the Vapor Compression Cycle*. Arlington, Virginia: AHRI, 2020.
5. AHRI. *AHRI 550/590 (I-P) 2020 with Addendum 1: Performance Rating of Water-chilling and Heat Pump Water-heating Packages Using the Vapor Compression Cycle*. Arlington, Virginia: AHRI, 2022.
6. AHRI. *AHRI 550/590 (I-P) 2023: Performance Rating of Water-chilling and Heat Pump Water-heating Packages Using the Vapor Compression Cycle*. Arlington, Virginia: AHRI, 2023.
7. AHRI. *AHRI 551/591 (SI) 2015: Performance Rating of Water-chilling and Heat Pump Water-heating Packages Using the Vapor Compression Cycle*. Arlington, Virginia: AHRI, 2015.
8. AHRI. *AHRI 551/591 (SI) 2015 with Addendum 1: Performance Rating of Water-chilling and Heat Pump Water-heating Packages Using the Vapor Compression Cycle*. Arlington, Virginia: AHRI, 2017.
9. AHRI. *AHRI 551/591 (SI) 2018 with Errata: Performance Rating of Water-chilling and Heat Pump Water-heating Packages Using the Vapor Compression Cycle*. Arlington, Virginia: AHRI, 2018.
10. AHRI. *AHRI 551/591 (SI/2020): Performance Rating of Water-chilling and Heat Pump Water-heating Packages Using the Vapor Compression Cycle*. Arlington, Virginia: AHRI, 2020.
11. AHRI. *AHRI 551/591 (SI) 2020 with Addendum 1: Performance Rating of Water-chilling and Heat Pump Water-heating Packages Using the Vapor Compression Cycle*. Arlington, Virginia: AHRI, 2022.
12. AHRI. *AHRI 551/591 (SI) 2023: Performance Rating of Water-chilling and Heat Pump Water-heating Packages Using the Vapor Compression Cycle*. Arlington, Virginia: AHRI, 2023.
13. ASHRAE. *Standard 34: Designation and Safety Classification of Refrigerants*. Atlanta, Georgia: ASHRAE, 2022.

RS0001.8 Example (Informative). See https://data.ashrae.org/standard205/examples.html

POLICY STATEMENT DEFINING ASHRAE'S CONCERN FOR THE ENVIRONMENTAL IMPACT OF ITS ACTIVITIES

ASHRAE is concerned with the impact of its members' activities on both the indoor and outdoor environment. ASHRAE's members will strive to minimize any possible deleterious effect on the indoor and outdoor environment of the systems and components in their responsibility while maximizing the beneficial effects these systems provide, consistent with accepted Standards and the practical state of the art.

ASHRAE's short-range goal is to ensure that the systems and components within its scope do not impact the indoor and outdoor environment to a greater extent than specified by the Standards and Guidelines as established by itself and other responsible bodies.

As an ongoing goal, ASHRAE will, through its Standards Committee and extensive Technical Committee structure, continue to generate up-to-date Standards and Guidelines where appropriate and adopt, recommend, and promote those new and revised Standards developed by other responsible organizations.

Through its *Handbook*, appropriate chapters will contain up-to-date Standards and design considerations as the material is systematically revised.

ASHRAE will take the lead with respect to dissemination of environmental information of its primary interest and will seek out and disseminate information from other responsible organizations that is pertinent, as guides to updating Standards and Guidelines.

The effects of the design and selection of equipment and systems will be considered within the scope of the system's intended use and expected misuse. The disposal of hazardous materials, if any, will also be considered.

ASHRAE's primary concern for environmental impact will be at the site where equipment within ASHRAE's scope operates. However, energy source selection and the possible environmental impact due to the energy source and energy transportation will be considered where possible. Recommendations concerning energy source selection should be made by its members.

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Founded in 1894, ASHRAE is a global professional society committed to serve humanity by advancing the arts and sciences of heating, ventilation, air conditioning, refrigeration, and their allied fields.

As an industry leader in research, standards writing, publishing, certification, and continuing education, ASHRAE and its members are dedicated to promoting a healthy and sustainable built environment for all, through strategic partnerships with organizations in the HVAC&R community and across related industries.

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